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Chemotaxonomy of Twelve Indian Taxa of *Blumea* DC. (Asteraceae)

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Abstract

The distribution of free amino acids, flavonoids and phenolic acids is studied in twelve species of *Blumea* DC. in order to assess their taxonomic significance. Species are rich in free amino acids. Lanthionine, DL- valine and leucine are present in eleven and proline in nine of the twelve taxa investigated, whereas DL-β-phenyl alanine, L – hydroxyproline and DL-2-amino–n-butyric acid are found specific. Flavonoids are detected in eight taxa while caffeic acid in seven. Much allied *B. oxyodonta* DC. and *B. eriantha* DC., and *B. membranacea* DC. and *B. virens* DC. showed dissimilar chemical nature.

Keywords : *Blumea*, Amino acids, Flavonoids, Phenolic acids

Introduction

The genus *Blumea* DC. (Asteraceae- Inuleae-Plucheineae) has always been problematic to students of taxonomy. Hooker (1881) remarked, 'the divisions of the genus proposed here are most unsatisfactory and I fear that the specific diagnoses are not much better. The glabrous or pubescent receptacle is very difficult to see; the size of the heads is tolerably constant; the foliage is sportive to an extraordinary degree, as is the pubescence'. Koster (1941) said, 'often the differences are too trifling to distinguish a separate species. Thus, polymorphous species are inevitable, of which moreover the conception of various authors is different. Their diagnoses of one and the same species are often considerably unlike, one describing the receptacle to be glabrous, the other describing it to be hirsute, etc. They create the dilemma; which is to be considered as a separate species and which is the variety of the polymorphous species'.

Variability in leaf form and uniformity in floral and acheneal characters are really frustrating. The work carried out by Randeria (1960) has solved many taxonomic issues in *Blumea*. Still, it is desirable to search avenues other than the traditional ones for taxonomic delimitations in the genus. This paper presents the chemical profile of twelve taxa of *Blumea* with regard to free amino acids and secondary metabolites like non-protein amino acids, flavonoids and phenolic acids.

Materials and Methods

Eleven species and one variety of *Blumea* investigated were collected from Maharashtra State and were identified at Botanical Survey of India, Pune (BSI). Voucher specimens are deposited in the herbarium of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad and they are mentioned along with the taxa (see Table 1).

Leaves were dried in shade or in oven at 35-40°C. Amino acids were extracted with 70% ethanol after treating dried leaf powder with chloroform for 24 hrs. The extract was further concentrated by evaporation on water bath. Two dimensional paper chromatography was employed for separation of amino acids following Harborne (1974). Final identification was done by comparing the spots with standard amino acids. Unidentified spots were denoted by their colour and relative positions with the nearest known amino acid. Flavonoids were extracted by methanol and processed for paper chromatography and spectroscopic identification following Mabry *et al.* (1970). Two dimensional paper chromatography was employed for separation and

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Table 1. Distribution of Amino Acids in *Blumea*

No	Name of Taxa	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
1.	*Blumea bifoliata* (L.)DC. Rewsa, *PYB 1*	+	-	-	+	-	+	-	+	-	+	-	+	-	-	-	-	-	-	+	-	7
2.	*Blumea eriantha* DC. Panwel, *PYB 3*	-	+	-	+	-	-	-	+	-	-	-	-	+	+	-	-	-	-	+	-	6
3.	*Blumea hieraciifolia* DC. var. *macrostachya* (DC.) Hook. f. Panwel, *PYB 34*	-	+	+	+	-	+	-	+	-	+	-	-	+	+	-	-	-	-	-	-	8
4.	*Blumea jacquemontii* Hook. f. Chikhaldara, *PYB 13*	-	-	+	+	-	-	-	+	+	+	-	+	-	-	+	-	-	+	+	-	9
5.	*Blumea malcolmii* (Cl.)Hook. f. Mahabaleshwar, *PYB 5*	+	-	+	+	-	+	-	+	+	+	-	-	+	-	+	-	-	+	+	+	12
6.	*Blumea membranacea* DC. Dhargad, *PYB 6*	-	-	-	-	-	-	-	+	+	-	-	-	+	+	+	+	-	+	+	-	8
7.	*Blumea obliqua* (L.) Druce Aurangabad, *PYB 7*	-	-	+	+	-	-	+	+	+	+	-	+	-	+	-	-	-	+	+	-	10
8.	*Blumea oxyodonta* DC. Pulgaon, *PYB 8*	+	-	-	+	-	-	-	+	-	+	-	+	+	-	-	+	-	-	+	-	8
9.	*Blumea sinuata* (Lour.) Merr. Rewsa, *PYB 4*	-	+	-	+	-	-	-	+	-	+	-	+	+	+	-	-	-	-	+	-	8
10.	*Blumea solidaginoides* (Poir.)DC. Rewsa, *PYB 9*	+	+	-	+	-	-	-	-	-	+	-	-	+	+	-	-	+	-	+	-	8
11.	*Blumea virens* DC. Thane, *PYB 10*	-	-	+	+	-	+	-	+	+	+	-	+	+	-	-	-	-	+	+	+	11
12.	*Blumea lacera* (Burm. f.) DC. var. *lacera* Thane, *PYB 11a*	+	-	+	+	+	-	-	+	-	-	+	-	-	-	-	-	-	+	+	-	8

1 DL – Methionine
2 Serine
3 Lysine hydrochloride
4 L – Leucine
5 L – Hydroxyproline
6 Threonine
7 Tryptophan
8 DL- Valine
9 iso-Leucine
10 Proline
*11 DL – Dopa
12 L-Tyrosine
13 Glutamic acid
14 DL-Alanine
15 Glycine
*16 DL- b - Phenyl alanine
*17 DL-2-amino-n-butyric acid
18 L-Histidine monohydrochloride
*19 Lanthionine
20 Unknown - Immediately below proline – violet – purple spot

* Non-Protein Amino Acids

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identification of phenolic acids (Ibrahim & Towers, 1960). Unidentified acids were denoted by their colour and relative positions with the nearest known phenolic acid.

Observations

Amino acids: Twenty different amino acids were identified in twelve taxa of *Blumea* (Table 1). Maximum twelve amino acids were detected in a single species (*B. malcolmii*) and minimum six (*B. eriantha*). DL-valine, L-leucine and lanthionine were the most common amino acids found in eleven and proline in nine out of twelve taxa investigated. L-hydroxyproline and DL-Dopa occurred only in *B. lacera* var. *lacera*, tryptophan in *B. obliqua* and DL-2-amino-n-butyric acid in *B. solidaginoides*.

Flavonoids: Species of *Blumea* appear to be poor in flavonoid content (see Table 2). The investigated species can be grouped into two on the basis of flavonoid distribution: 1. taxa with flavonoids (7 spp.) and 2. taxa without flavonoids (5 spp.). Taxa with flavanoids can be divided as those with only flavones (*B. hieraciifolia* var. *macrostachya*, *B. malcolmii*, *B. obliqua* and *B. sinuata*) and those with flavones and flavonols (*B. bifoliata*, *B. lacera* var. *lacera* and *B. oxyodonta*).

Phenolic acids: Twenty four different phenolic acids (seventeen known and seven unknown) were found in twelve taxa (see Table 3). Maximum ten phenolic acids were detected in a single species (*B. obliqua*) and minimum three in two species (*B. sinuata* and *B. virens*). Syringic acid was found in all, vanillic in nine and caffeic in seven taxa. Salicylic, b- resorcylic, 3-OH, 5-OCH_3 benzoic, o-coumaric and phloretic acids were found only in *B. malcolmii*, *B. membranacea*, *B. oxyodonta*, *B. jacquemontii*, *B. solidaginoides* respectively and ferulic and trans-þ-coumaric acids only in *B. obliqua*.

Discussion

Of the 2,000 species of Inuleae only 5 to 10% are chemically investigated. Data on the distribution of free amino acids in these species are not available. The present study reveals that species of *Blumea* are rich in free amino acids. Proline, a physiologically important amino acid, is found in nine species. Proline accumulation is directly related to water stress condition (Hanson *et al.*, 1977) and is indicative of

Table 2. Distribution of Flavonoids in *Blumea*

No.	Name of Taxa	1	2	3	4	5	6	7
1.	*Blumea bifoliata* (L.)DC.	-	-	-	+	-	-	+
2.	*Blumea eriantha* DC.	-	-	-	-	-	-	-
3.	*Blumea hieraciifolia* DC. var. *macrostachya* (DC.) Hook.f.	-	+	+	-	-	-	-
4.	*Blumea jacquemontii* Hook. f.	-	-	-	-	-	-	-
5.	*Blumea malcolmii* (Cl.)Hook. f.	-	-	-	+	-	-	-
6.	*Blumea membranacea* DC.	-	-	-	-	-	-	-
7.	*Blumea obliqua* (L.)Druce	+	+	+	-	-	-	-
8.	*Blumea oxyodonta* DC.	-	-	-	+	-	-	+
9.	*Blumea sinuata* (Lour.)Merr.	-	-	-	+	+	-	-
10.	*Blumea solidaginoides* (Poir.)DC.	-	-	-	-	-	-	-
11.	*Blumea virens* DC.	-	-	-	-	-	-	-
12.	*Blumea lacera* (Burm.f.)DC.var.*lacera*	-	-	-	+	-	-	+

1 Apigenin 2 4′-OMe Apigenin 3 7, 4′-di OMe apigenin
4 3′, 4′-di OMe Luteolin 5 7′, 3′, 4′-tri OMe Luteolin 6 3-OMe Quercetin

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Table 3. Distribution of Phenolic Acids in Blumea

No	Name of Taxa	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Unknown							Total
																			1	2	3	4	5	6	7	
1.	*Blumea bifoliata* (L.)DC.	-	+	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	4
2.	*Blumea eriantha* DC.	-	+	-	-	-	-	+	+	-	-	+	+	-	-	+	-	-	-	-	-	-	-	-	-	6
3.	*Blumea hieraciifolia* DC. var. *macrostachya* (DC.) Hook.f.	-	+	-	+	-	-	+	+	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	6
4.	*Blumea jacquemontii* Hook. f.	-	-	-	-	+	-	-	+	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	4
5.	*Blumea malcolmii* (Cl.)Hook. f.	+	-	-	-	-	-	+	+	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	5
6.	*Blumea membranacea* DC.	-	-	+	-	+	-	-	+	-	-	+	-	-	-	+	-	-	-	-	-	+	-	-	+	7
7.	*Blumea obliqua* (L.)Druce	-	+	-	-	-	-	+	+	-	-	-	+	+	-	-	+	+	+	-	-	-	-	+	+	10
8.	*Blumea oxyodonta* DC.	-	+	-	-	-	-	+	+	+	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	6
9.	*Blumea sinuata* (Lour.)Merr.	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	3
10.	*Blumea solidaginoides* (Poir.) DC.	-	-	-	-	-	-	+	+	-	-	+	-	-	+	-	-	-	-	+	+	-	+	-	-	7
11.	*Blumea virens* DC.	-	+	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
12.	*Blumea lacera* (Burm.f.) DC.var.lacera	-	-	-	-	-	-	+	+	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	4

Key to known phenolic acids

1 Salicylic	2 þ-OH-Benzoic	3 β– Resorcylic
4 Gentisic	5 Proto catechuic	6 a - Resorcylic
7 Vanillic	8 Syringic	9 3-OH, 5-OCH_3 benzoic acid
10 o-Coumaric	11 Melilotic	12 þ –Coumaric
13 Trans-p-coumaric	14 Phloretic	15 Caffeic
16 Ferulic	17 Trans-Ferulic	

Key to Unknown phenolic acids

	Colour Reaction		Relative position
	p-nitroaniline	Sulfanilic acid	
1	Violet	Violet	Just below caffeic acid
2	Pink	Pink	Between the starting line and caffeic acid
3	Pink	Pink	Near Sinapic acid
4	Violet	Violet	Just above caffeic acid
5	Blue green	Blue green	At highest Rf 1 x 1
6	Green	No reaction	Just above Caffeic acid
7	Pink	No reaction	Just above Caffeic acid

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the arid habitat where most of these species are found in Maharashtra. Specific amino acids detected in individual taxa can function as taxonomic markers.

Bose *et al.* (1968) studied flavonoids in *B. eriantha*. They noted the presence of Quercetagetin 3,6,7,3'4'–pentamethyl ether. However, we found *B. eriantha* devoid of any flavonoid compound. Possibly, they might have studied different ecotypes or chemotypes of *B. eriantha*. It is not uncommon to find flavonoid chemistry differing with climate or habitat (Giannasi, 1972; Karen & Clifford, 1984). Interestingly, the total absence of flavonoids was observed in five species (Table 2). They may be chemically regarded as the most advanced. Species containing both flavones and flavonols are taken to be relatively primitive while those having flavones alone are considered relatively advanced. Methoxy derivates of luteolin and apigenin found in *Blumea* are widely distributed in Asteridae (Harborne, 1967). Chalcones and aurones are the important sources of yellow colour pigments in Asteraceae. In Inuleae they are reported from *Gnaphalium* and *Helichrysum* (Harborne, 1977). Although yellow colour is dominant in flowers of *Blumea*, these pigments were absent in the investigated taxa when tested with ammonia.

Among phenolics, caffeic acid is one of the major constituents in Asteraceae (Hegnauer, 1977). However, vanillic acid occurred more frequently than caffeic acid in the taxa studied. *B. eriantha* and *B. oxyodonta* are taxonomically very similar. Erect habit and male fertile central florets distinguish the former from the latter. Intermediate forms (e.g. male sterile central florets and erect habit, male fertile central florets and prostrate habit etc.) make this distinction more difficult. However, these two species exhibit distinct chemical profiles.

Chemical profile	*B. eriantha*	*B. oxyodonta*
Amino acids		
a) DL-methionine, proline tyrosine, DL- b - phenyl alanine	Absent	Present
b) DL-serine, DL-alanine	Present	Absent
Flavonoids		
3',4'-di OMe Luteolin	Absent	Present
Phenolic acids		
a) β - resorcylic, 3-OH, 5-OCH_3, unknown no. 1	Absent	Present
b) þ-OH benzoic, melilotic þ –coumaric	Present	Absent

Likewise, *B. membranacea* and *B. virens* are similar in their external morphology. *B. membranacea* is distinguished from *B. virens* only on the basis of the degree of pubescence (the former being pubescent and the latter almost glabrous) and the slight difference in size of heads. However, they show the following chemical differences.

Chemical profile	*B. membranacea*	*B. virens*
Amino acids		
a) L-lysine hydrochloride L-leucine threonine proline, L-tyrosine Unknown.	Absent	Present
b) DL-alanine, glycine DL-β- phenyl alanine	Present	Absent
Phenolic acids		
a) þ-OH-benzoic, vanillic	Absent	Present
b) β - resorcylic, proto catechuic melilotic, caffeic unknown 4,7	Present	Absent

Chemical characters also show that *B. oxydonta* and *B. virens* are more advanced than *B. eriantha* and *B. membranacea* respectively.

Elaborate chemical studies may provide better insight to the taxonomy of *Blumea*.

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The authors are indebted to the authorities of Government Vidarbha Institute of Science and Humanities, Amravati and Botanical Survey of India (WC), Pune for the help and facilities extended. They are also grateful to Prof. S.D. Sabnis and Dr. M. Daniel of the M.S. University of Baroda for their guidance in phytochemical investigation. The junior author is thankful to the University Grants Commission, New Delhi, for financial assistance.

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Notes on *Zeuxine* Lindl. (Orchidaceae) from Tamil Nadu, India

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Abstract

Four species of *Zeuxine* (Orchidaceae) - *Z. affinis* (Lindl.) Benth. ex Hook. f., *Z. flava* (Wall. ex Lindl.) Benth. ex Hook f., *Z. gracilis* (Breda) Bl. and *Z. longilabris* (Lindl.) Benth. ex Hook. f. - are reported from Tirunelveli Hills in Southern Western Ghats of Tamil Nadu, India. All are illustrated and described based on new collections. The discovery of *Zeuxine affinis* constitutes a new distributional record for Tamil Nadu. Artificial keys for all the four species are given.

Keywords : *Zeuxine*, new reports, keys, Tirunelveli Hills

Introduction

Zeuxine is a delicate terrestrial genus of orchids growing in the humus of lowland to the montane evergreen forests. It has 70 species widely distributed from tropical Africa and Madagascar through India, Sri Lanka, and to the Pacific Islands (Pridgeon *et al.*, 2003). Of this, 15 species are found in India (Sathish Kumar, 2001). Hooker (1890) mentioned only *Zeuxine longilabris* (Lindl.)Benth. ex Hook.f. and *Z. sulcata* Lindl. (*Z. strateumatica* (L.) Schltr.) from South India, while Fischer (1928) reported, besides the above two species, *Z. blatterii* Fischer also. Abraham and Vatsala (1981) and Henry *et al.* (1989) reported only *Z. longilabris* and *Z. gracilis*. Sathish Kumar (2000) reported only *Z. longilabris* from Tamil Nadu. Five year long floristic study conducted in Tirunelveli hills and the environs yielded three more species: *Z. affinis* (Lindl.) Benth. ex Hook. f., *Z. flava* (Wall. ex Lindl.) Benth. ex Hook f. and *Z. gracilis* (Breda) Bl. They are described, illustrated and keyed out below.

1a. Lip 10-20 mm long 2
1b. Lip 3-5 mm long 3
2a. Lobules of lip coarsely toothed; sepals and petals 3-veined ..... ***Z. longilabris***
2b. Lobules of lip with undulate margin; sepals and petals 1 veined ..... ***Z. affinis***
3a. Midlobe of the lip entire ..... ***Z. gracilis***
3b. Midlobe of the lip divaricate ..... ***Z. flava***

Zeuxine affinis (Lindl.) Benth. ex Hook. f., Fl. Brit. India 6: 108. 1890 & IC Pl. t. 2177. 1894. Seidenf., Dansk Bot. Ark. 32: 88. 1978. Sasidharan *et al.*, Rheedea 9(2): 159. 1999. *Etaeria affinis* Lindl. in Wall. Cat. No. 7383. 1832 *nom. nud. Monochilus affinis* Lindl., Gen. Sp. Orch. 487. 1840. *p.p.* **Fig. 1.**

Rhizomatous herbs, to 30 cm high. *Rhizomes* creeping, rooting at nodes. *Leaves* 4-5, greenish-brown membranous, ovate-lanceolate, 3.5-5 x 1.5-2 cm, sheathed at base, entire, acute at apex. *Inflorescence* terminal, erect, spicate raceme, 10-15 cm long; peduncle 6-8 cm long, glandular pubescent with 2-3 sheaths; *bracts* ovate-lanceolate, acuminate, 8 x 2 mm, as long as the ovary, 1-veined, glandular pubescent. *Flowers* white; pedicel 1.5 mm long; sepals subequal glandular pubescent, 1-veined, obtuse; dorsal sepal ovate, 7.5 x 3.5 mm, lateral sepal oblong, 6 x 2 mm; petals falcately oblong, 7 x 3 mm, obtuse, 1-veined, connate with dorsal sepal; lip 12 x 10 cm, saccate at base with two cylindrical acute glands, dilating and deeply bilobed; lobes obovate, margin undulate; column 1.8 mm long; stigma with two glandular protuberances at the sides; anther 2-celled; pollinia pyriform, 1.5 mm long, with 0.5 mm stalk on a small, ovate gland at the base; rostellum oblanceolate, 0.8 mm long, slightly curved; ovary with pedicel 10 mm, ridged, pubescent. *Capsule c.* 10 mm long.

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Flowering & Fruiting: February-March.

Altitude: 1400 m.

Habitat: Evergreen forests.

Occurrence: India, Tamil Nadu, Kanyakumari District.

Distribution: India, China, Myanmar, Thailand, Laos and Malaysia.

Specimens Examined: INDIA, **Tamil Nadu**, Kanyakumari district: Mahendragiri hills, way to Parvatham, *Manickam et al. 18767* (XCH).

Note: Sasidharan *et al.* (1999) reported this species from Kerala as a new record for Peninsular India.

Zeuxine flava (Wall. ex Lindl.) Benth. ex Hook. f., Fl. Brit. India 6: 108. 1890; Seidenf, Dansk Bot. Ark.

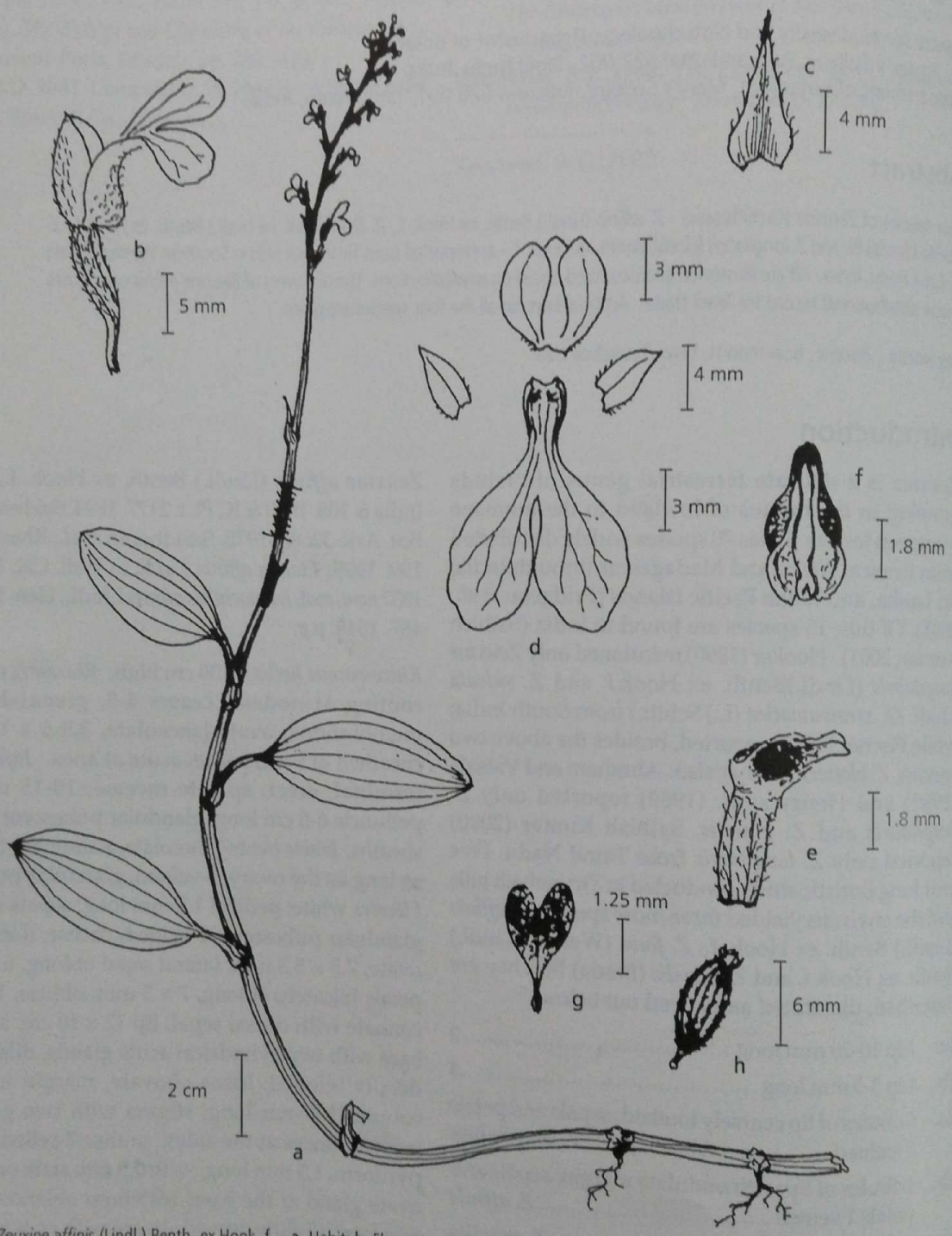

Figure 1. *Zeuxine affinis* (Lindl.) Benth. ex Hook. f. – **a**. Habit; **b**. Flower; **c**. Bract; **d**. Sepals, Petals and Lip; **e**. ovary with column; f. Column, front view; **g**. Pollinia; **h**. Fruit.

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32: 84. 1978; Jayaweera in Dassanayake & Fosberg, Rev. Handb. Fl. Ceylon. 2: 328. 1981. *Etaeria flava* Lindl. in Wall. Cat. n. 7380. A & B. 1832, *nom. nud*. *Monochilus flavum* Wall. ex Lindl. Gen. Sp. Orch. 487. 1840. **Fig. 2.**

Rhizomatous herbs, 10-25 cm tall. *Leaves* 3-5, greenish brown, ovate, 4-5 x 2-5 cm, acute, 5-veined; petiole short, sheathing at node. *Inflorescence* a terminal spicate raceme, 12-15 cm long; peduncle up to 8 cm, pubescent, with 2-3 sheath of 1.5 cm long; floral bract ovate-lanceolate, acuminate, 5 x 2 mm, 1-veined, pubescent. *Flowers* white; sepals subequal, 1-veined, obtuse, pubescent; dorsal sepal ovate, 3.5-4 x 3 mm; lateral sepals, ovate-lanceolate, 3-3.5 x 2 mm; petals oblong, 3-3.5 x 1.5 mm, 1-veined; lip orange yellow, 4-5 mm long, saccate at base with two conical calli, claw expanded into oblong, quadrate, divaricate, 3-veined wings; column 3.5 mm long; anthers 2 loculed,

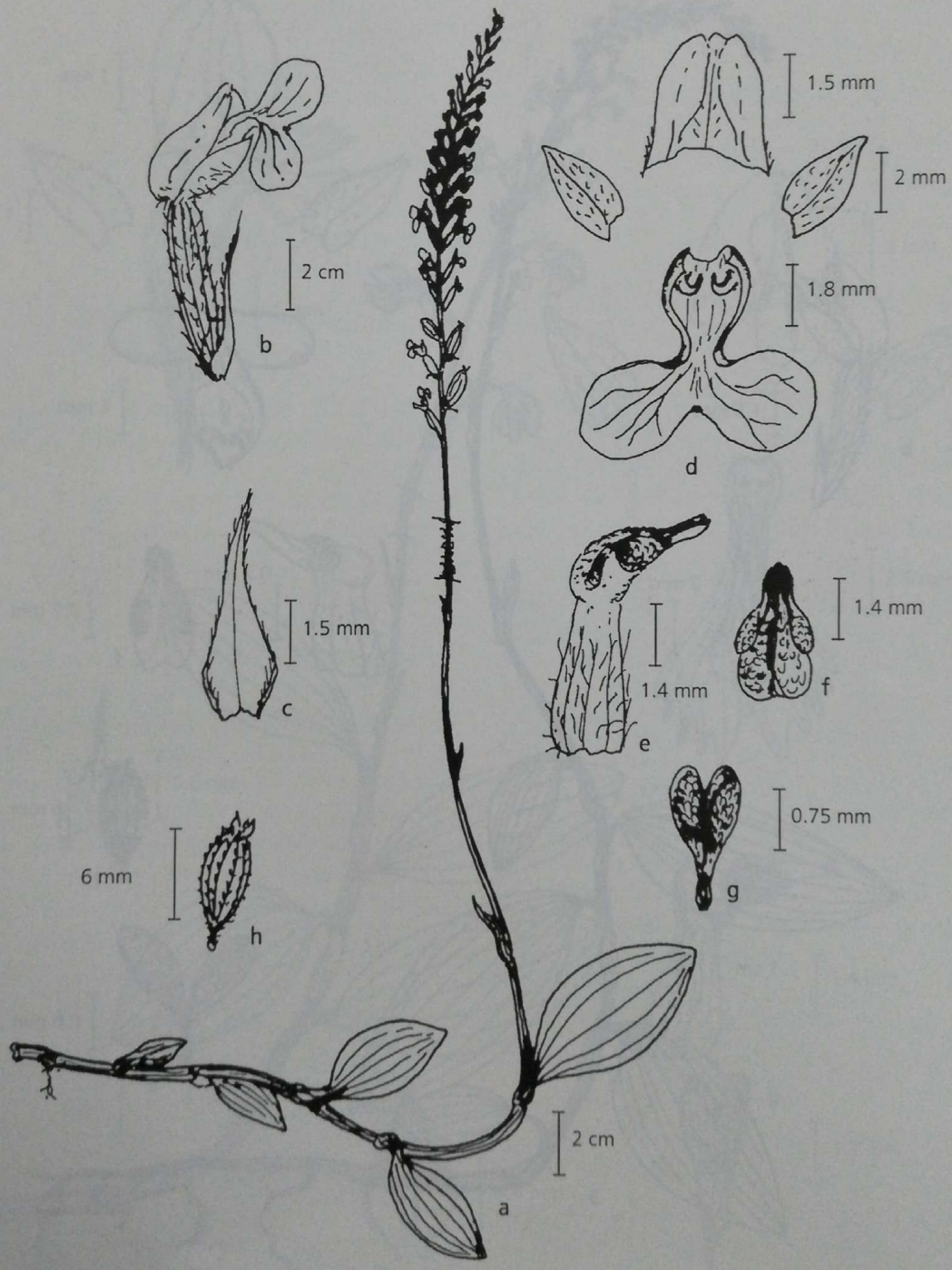

Figure 2. *Zeuxine flava* (Wall. ex Lindl.) Benth. ex Hook. f. – **a**. Habit; **b**. Flower; **c**. Bract; **d**. Sepals, Petals and Lip; **e**. Ovary with column; **f**. Column, front view; **g**. Pollinia; **h**. Fruit.

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1 mm long; pollinia 2, 1.5 mm long, pyriform, shortly stipitate on oblong gland; rostellum bipartite with erect segments; ovary to 5 mm long, ridged, pubescent. *Capsule* ellipsoid, *c.* 8 mm long.

Flowering & Fruiting: March-April.

Altitude: 1000-1400 m.

Habitat: Evergreen forests.

Occurrence: India, Tamil Nadu: Tirunelveli an Kanyakumari Districts.

Distribution: India, Nepal, Myanrmar and Thailand

Specimens Examined: INDIA, **Tamil Nadu**, Tirunelve District: Kothayar hills, *Manickam et al. 12499 & 1254* (XCH); Papanasam hills, Valayar, *Manickam et al. 1888* (XCH); Kalakad hills, Kakkachi path, *Manickam et al. 1959*

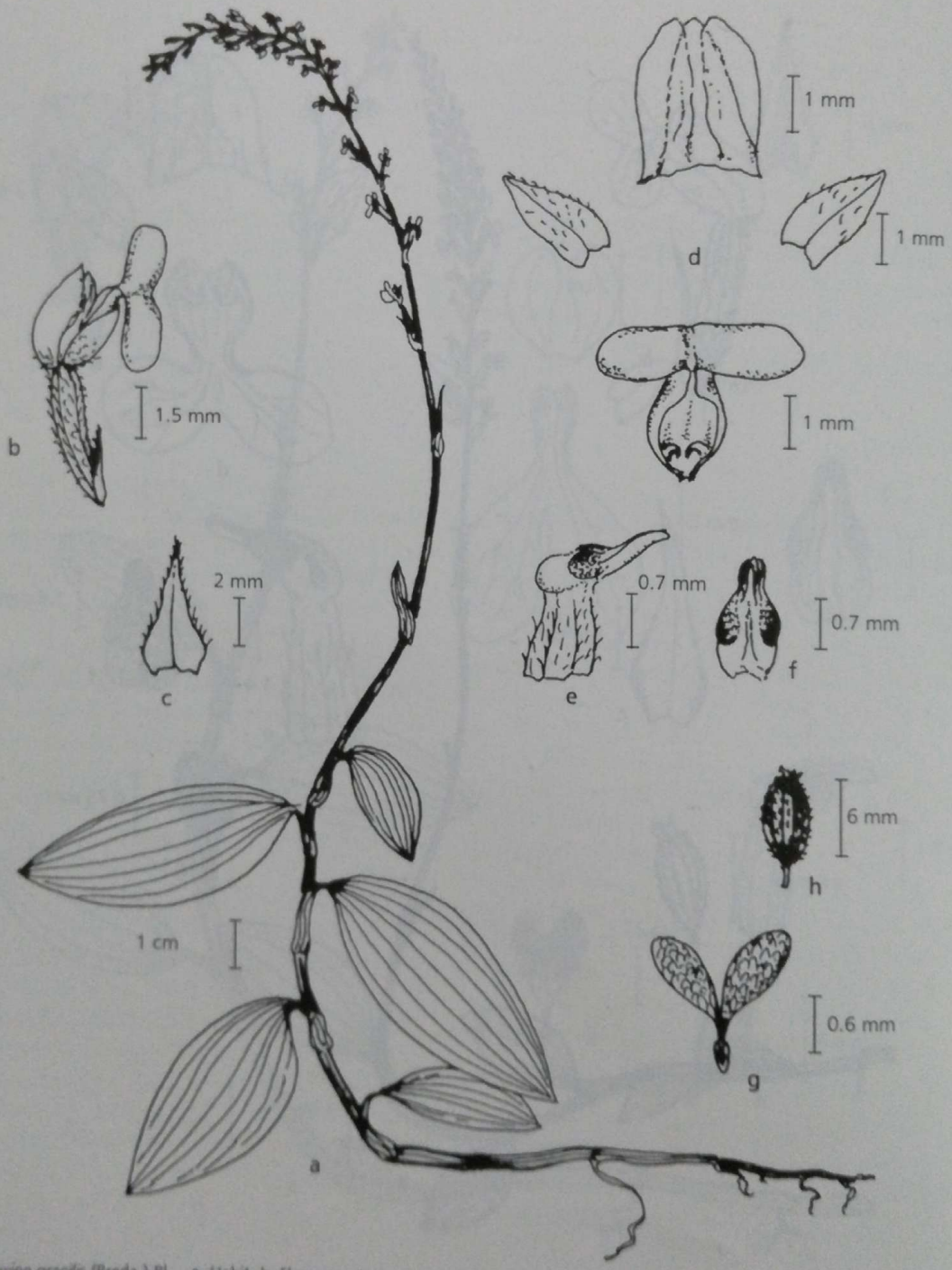

Figure. 3. *Zeuxine gracilis* (Breda.) Bl. – a. Habit, b. Flower; c. Bract; d. Sepals, Petals and Lip; e. Ovary with column; f. Column, front view; g. Pollinia h. Fruit.

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(XCH); Kanyakumari District: Mahendragiri hills, *Manickam et al. 18597* (XCH).

Zeuxine gracilis (Breda) Bl., Coll. Orch. Ind. Arch. 69, T. 18, Fig. 2 & T. 23. D. 1858; Abraham & Vatsala, Introd. Orch. 205. 1981; Joseph & Ansari in Henry *et al.*, Fl. Tamil Nadu 3: 26. 1989. *Psychechilos gracile* Breda, Gen. Sp. Orchid Asclep. t. 9. 1827. *Zeuxine blatterii* Fischer, Kew Bull. 1928: 76. 1928 & in Gamble's Fl. Pres. Madras 3: 1456. 1928. **Fig. 3.**

Rhizomatous herbs, 10-25 cm tall. *Rhizome* creeping, rooted at nodes. *Leaves* 2-5, greenish brown, ovate-lanceolate, 3-6 x 2-2.5 cm, acute. *Inflorescence* a terminal spike to 12 cm; peduncle to 5 cm, glandular with 2-3 basal sheaths; floral bracts lanceolate, acuminate, 6 x 1 mm, pubescent. *Flowers* white; sepals subequal, pubescent, 1-veined, acute; dorsal sepal ovate, 3-4 x 2 mm; lateral sepals ovate-lanceolate, 2.5-3 x 2 mm; petals ovate, 3-3.5 x 2 mm,

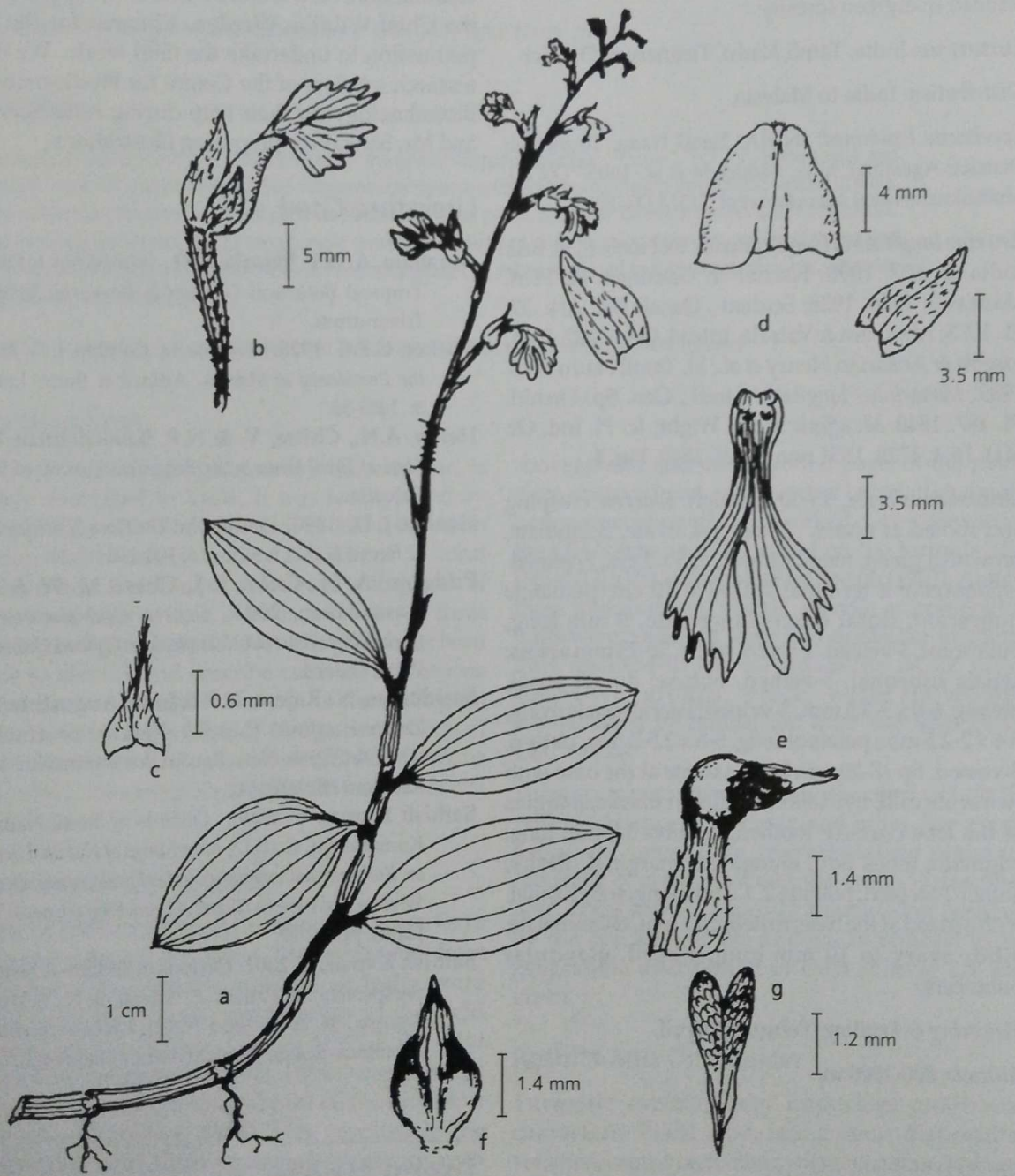

Figure 4. *Zeuxine longilabris* (Lindl.) Benth. ex Hook. f. – **a**. Habit, **b**. Flower; **c**. Bract; **d**. Sepals, Petals and Lip; **e**. Ovary with column; **f**. Column, front view; **g**. Pollinia.

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1-veined; lip 3-3.5 mm long, saccate at base with two pointed calli; lobules white, orbicular, entire, sac of the lip yellow; column 1.8 mm long Anther with two locules, 1 mm long; pollinia 2, pyriform, 1 mm long, attached to an oblong gland; stigma fleshy; rostellum bipartite; ovary 4 mm long, glandular pubescent. *Capsule* ellipsoid, *c.* 8 mm long.

Flowering & Fruiting: February - April.

Altitude: 900m.

Habitat: Evergreen forests.

Occurrence: India, Tamil Nadu, Tirunelveli District.

Distribution: India to Malesia.

Specimens Examined: INDIA, **Tamil Nadu**, Tirunelveli District: Agasthiar hills, *Manickam et al*. 19057 (XCH); Muthukuzhyvayal *Manickam et al*. *21518* (XCH).

Zeuxine longilabris (Lindl.) Benth. ex Hook. f., Fl. Brit. India. 6: 107. 1890; Fischer in Gamble's Fl. Pres. Madras 3: 1456. 1928; Seidenf., Dansk Bot. Ark. 32: 91. 1978; Abraham & Vatsala, Introd. Orch. 202. 1981; Joseph & Ansari in Henry *et al*., Fl. Tamil Nadu 3: 26. 1989. *Monochilus longilabre* Lindl., Gen. Sp. Orchid. Pl. 487. 1840. *M. affinis* sensu Wight, Ic. Pl. Ind. Or. 5(1): 16. t. 1728. 1851 non Lindl. 1840. **Fig. 4**

Rhizomatous herbs, 15-30 cm high. *Rhizome* creeping and rooted at nodes. *Leaves* 3-4, ovate, acuminate, brownish green, membranous, 5.5 x 2 cm, 7-veined. *Inflorescence* a terminal spike, to 10 cm; peduncle pubescent; floral bracts lanceolate, 8 mm long, pubescent, 3-veined. *Flowers* white, 20-25 mm across; sepals subequal, 3-veined, obtuse; dorsal sepal, oblong, 6-8 x 3-3.5 mm, 3-veined; lateral sepals ovate, 5-6 x 2-2.5 mm; petals oblong, 5-6 x 2.5-3 mm, obtuse, 3-veined; lip 15-20 mm long, saccate at the base with two acute calli, two lobed, midlobe cuneate, margins of the lobe coarsely toothed; column 3.5 mm long; stigmatic lobes two, elongated, marginal, fleshy; anther 2-loculed; pollinia 2, 1.2 mm long, subglobular, with a gland at the base; rostellum 1 mm, oblanceolate, bifid; ovary to 10 mm long, ribbed, glandular pubescent.

Flowering & Fruiting: February-April.

Altitude: 800-1000 m.

Habitat: Evergreen forests.

Occurrence: India, Tamil Nadu, Tirunelveli District.

Distribution: India, Sri Lanka, Cambodia and Thailand.

Specimens Examined: INDIA, **Tamil Nadu**, Tirunelveli District: Sivagiri hills, *Manickam et al. 19988* (XCH).

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